

Brief Report: External Beam Radiation Therapy for the Treatment of Human Pluripotent Stem Cell-Derived Teratomas.

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Authors:	Andrew S Lee, Chad Tang, Wan Xing Hong, Sujin Park, Magdalena Bazalova-Carter, Geoff Nelson, Veronica Sanchez-Freire, Isaac Bakerman, Wendy Zhang, Evgenios Neofytou, Andrew J Connolly, Charles K Chan, Edward E Graves, Irving L Weissman, Patricia K Nguyen, Joseph C Wu
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Public Summary:

Human pluripotent stem cells, including human embryonic stem cells (hESCs) and human induced PSCs (hiPSCs), have great potential as an unlimited donor source for cell-based therapeutics. The risk of teratoma formation from residual undifferentiated cells, however, remains a critical barrier to the clinical application of these cells. Herein, we describe external beam radiation therapy (EBRT) as an attractive option for the treatment of this iatrogenic growth. We present evidence that EBRT is effective in arresting growth of hESC-derived teratomas in vivo at day 28 post-implantation by using a microCT irradiator capable of targeted treatment in small animals. Within several days of irradiation, teratomas derived from injection of undifferentiated hESCs and hiPSCs demonstrated complete growth arrest lasting several months. In addition, EBRT reduced reseeding potential of teratoma cells during serial transplantation experiments, requiring irradiated teratomas to be seeded at 1×10^3 higher doses to form new teratomas. We demonstrate that irradiation induces teratoma cell apoptosis, senescence, and growth arrest, similar to established radiobiology mechanisms. Taken together, these results provide proof of concept for the use of EBRT in the treatment of existing teratomas and highlight a strategy to increase the safety of stem cell-based therapies.

Scientific Abstract:

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